

## 20.—Population Studies in the Littoral at Rottnest Island

Preliminary studies have been carried out on a common crustacean and a common mollusc of the rocky shores.

*Leptograpsus variegatus*.—This species of rock crab is ubiquitous throughout the rocky shores of the temperate southern hemisphere. On Rottnest the females are carrying eggs externally from September through the spring and early summer until the end of February. Moulting, as gauged by the feel of soft carapaces when handling the animals, occurs at all seasons but seems to increase in frequency just before and just after the season when the females are carrying eggs. The animals are omnivorous scavengers. They have been noted eating dead fish and limpets detached from the rocks, but they appear to live mainly on the marine algae which they pick from the rock with their pincers.

The natural habitat of these crabs is on rocky surf-exposed shores and rocks just above the water line. During the day they retire into rock crevices or hide in rock debris. However they are known to move about in the shadow during the day but are extremely wary and retreat to cover in a flash if approached by an observer. At night the behaviour pattern is entirely changed. When approached by an observer with a flashlight the crabs in most instances remain motionless or continue eating. Their capture and examination is extremely easy under these conditions.

As the specific name indicates, *Leptograpsus* is noted for the individual colour variation which ranges from a very dark blue to orange and a light slate colour. By arranging some 200 of these crabs in a colour sequence it was obvious that this great variation in colour was not continuous but discrete. There were in fact only two distinct colour groups the one a blue phase and the other an orange grading into slate. The latter phase contained a preponderance of orange coloured males and, contrariwise, a preponderance of slate coloured females.

The study method used is to walk along the reef platform at night with a flashlight in several selected study areas and by this linear traverse method score some 150-200 crabs for colour phase, sex, place in the undercut (whether in the splash zone, water, or on the dry rock face). The linear sequence of such observations is preserved. The study areas have in most instances been marked with paint division lines—generally the whole traverse is divided into 10 subdivisions.

Analysis to date of these traverse scorings has revealed several interesting facts. Firstly the colour phases seem to have differing affinities for the rock positions where they feed. Blue phase crabs show a propensity to locate themselves higher up on the rock face whilst the orange and slate colours have a tendency to be found lower down on the wet rock face or actu-

ally in the water. Secondly, by subdividing the traverse it has been possible to determine whether the one phase tends to inhabit a certain locality. This has proved the case; certain areas have a stable population of one phase rather than the other and this stability is maintained throughout the season. One study traverse—Wilson Bay—has been intensively worked over a period of two years and the above results are mainly from this place. However about 6 other standard study traverses have been worked and the analysis from all these places supported that from Wilson Bay. It appears that the orange/slate phase prefers the wetter part of its habitat. It inhabits the lower part of the reef predominating where the undercut faces open or broken water, i.e., those sections of the traverse having a preponderance of orange phase animals are generally those where the surf breaking on the rock is more intense.

Here then we have a polymorphic species in which the morphs have separate ecological preferences. These preferences are not absolute ones but are only revealed and statistically established after a large number of observations. Perhaps this species is in the process of splitting into two species in an early stage of Darwinian evolution.

*Melanerita melanotragus*.—The black periwinkle *Melanerita melanotragus* abounds on the limestone surf rocks about mean sea level over the whole of Rottnest. It has attracted interest as an experimental animal for population studies because of several of its attributes. The variation in size of individuals of the various colonies throughout the island is great. In areas where there is a low density the animals tend to grow to a large size and where the concentration is high they are of a relatively small average size. Moreover these average sizes and the population size compositions have not changed over a period of 5 years. Four experimental populations have been divided into 5 size classes over this period by sieving through standard mesh screen; all populations appear to be maintaining their size composition. Further work is devoted to determining whether this stability is environmental or genetic, or whether the fortuitous initial density of animals is the controlling factor.

Some five years of marking of individual animals indicates that the extreme age of the animals can probably exceed 15 years. In addition this work has shown that although in general the animals are restricted in their movements they can move up to 16 feet over the rock face in one night.

The studies are proceeding mainly with the aid of student labour; further work is to be devoted towards establishing life tables for the several study populations.

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